6928-23

TECHNICAL PROPOSAL

A PROPOSAL FOR ESTABLISHMENT OF AN IMAGE ENHANCEMENT AND RECONSTRUCTION FACILITY PHASE I

STATINTL

12 FEBRUARY 1969

SECTION I

INTRODUCTION

During recent years, there has been considerable interest in the maximum extraction of information from image forming systems, particularly through the application of information theory to image data. [redacted] has been active STATINTL in this new discipline, both from theoretical and applied points of view. This proposal is presented for the purpose of disclosing the details of a unique image enhancement and reconstruction system developed by [redacted] over the last five STATINTL years. The system was developed as an "in house" program, and patent action has been taken to protect the proprietary nature of the disclosures herein.

This Phase I proposal is submitted as a 12-month effort for the purpose of providing equipment and services for a digital scanning and recording system. The effort is divided into two parts, which will be carried out concurrently. Part One will be concerned with adapting the existing Trichoic Microdensitometer equipment to a precision raster scan mode configuration, while Part Two will be concerned with services for the scanning, manipulation, and display of selected imagery to provide the necessary experience and knowledge for development and adaption of specialized software for image exploitation.

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SECTION 2
TECHNICAL DISCUSSION

A. HARDWARE

I. Hardware Modification

The hardware portion of this program shall consist of modification of the Trichoic Microdensitometer for adapting it to a precision raster scan capability. The conversion shall consist of the addition of a 25-kHz solid state amplifier for conversion of the transmission analog signal to a density analog signal, a modification of the X-axis drive system to increase the scanning speed, the addition of a circulating oil pump and special hydraulic drive nut to provide constant lubrication to the X-axis drive system, conversion of the X-axis reversing switches to noncontact switching means, addition of a 1/4-micron Y-axis step-over control with automatic scan count and shutdown. The optical system will be modified to provide sampling of 1-micron and 1/2-micron diameter areas using Epiplan 8-power and/or 16-power lenses.

II. Micro-Analyzer Control and Data Logging System

This electronic subsystem controls the scanning of the Micro-Analyzer and records the output density signal in computer-acceptable form. It is composed of the following units:

1. X-Axis Scan Controller
2. Y-Axis Step-Over Unit
3. Digital Data Logging Unit

The X-Axis Scan Controller employs solid state switches to control the direction and the stop/start of the X-axis scanning. Input to the unit is either from manual pushbuttons on the control panel or from adjustable scan limit sensors on the Micro-Analyzer. In automatic mode, the Micro-Analyzer stage will scan back and forth between the set limits.

The Y-Axis Step-Over Unit controls the Y-axis motion of the Micro-Analyzer stage. Y-axis motion is incremental and occurs between X-axis scans, that is, during the X-axis reversal time. The size of each Y-axis step is manually selectable from 1/4 to 999-3/4 microns in 1/4-micron increments. The succeeding X-axis scan is delayed until Y step-over is completed. This unit also terminates scanning after the preset number of scans (1 to 9999) have been completed. The direction of the Y-axis scan is selected with a switch on the control panel.

The Digital Data Logging Unit digitally records the output density signal on a computer-compatible magnetic tape. Signal sampling and 60-Hz power for the X-axis scan motor are both derived from a crystal-controlled oscillator. Thus, time between samples can be directly related to distance without requiring stage position monitoring.

In normal raster scan operation, density samples are temporarily stored digitally in a core memory during a complete X-axis scan. At the end of the scan line, the data are then rapidly transferred from core memory to magnetic tape and recorded as one block. Each tape character is read immediately after it is recorded and checked for proper parity. If an error is detected, the tape is reversed to the beginning of the block and the complete block, stored in the core memory, is re-recorded. The start of the next X-axis scan is inhibited until this is completed. Should an error be detected on the second recording, the operator has the option of either terminating at that point or continuing automatically with the bad block retained. In the latter case, a counter will indicate the number of bad blocks retained during a run.

Each sample is recorded as an eight-bit binary number. Controls permit zero offset and gain adjustment so that these eight bits can be set to cover a selected portion of the overall density range. A decimal display, ahead of the zero offset and gain adjust, is also provided to indicate the output of the Micro-Analyzer amplifier.

DIGITAL DATA LOGGER SPECIFICATIONS

Sample Size:	8 binary bits
Sampling Rates:	10, 25, 50, 100, 250, 500, 1000, 2500, 5000, 10,000, 25,000 samples per second.
Samples per Scan:	Up to 8192. Selected with control panel switches.
Tape Format:	(IBM-compatible)
Number of Channels:	Nine
Density:	800 characters per inch.
Block Size:	8192 characters maximum.

Methods for Starting Sampling:

1. Manual:	Pushbutton switch
2. Edge Trigger:	Starts when input density signal crosses preset level.
3. External:	Signal change from zero to + 5 volts

Methods for Stopping Sampling:

1. Manual:	Pushbutton switch
2. Programmed:	Stops after preset number of samples (8192 max.)
3. External:	Signal change from zero to + 5 volts
4. Limit:	Automatically stops at 8192 samples

Accuracy of First Sample:

Time between "Start" signal and the first sample is equal to the selected time between samples ± 3.5 microseconds. (Example: At sampling rate of 500 samples per second, the first sample will be taken 2000 ± 3.5 microseconds after the "Start" signal.)

Timing Source Accuracy: ± 0.005%

Maximum Recording Time (between scans):

0.15 second (no error)

0.5 second (with error)

Error Indication:

Each digital sample is checked for proper parity as it is read from memory and after recording on tape. Detection of an error causes the proper indicator (Memory or Tape) to be illuminated and also initiates the re-record cycle. Error indicators are manually reset.

End of File:

Pushbutton switch causes Tape Mark to be recorded at end of run.

B. SERVICES

I. System Program Packages Operational on a 360 Model 40

System program packages, operational on a 360 Model 40 system, will be tailored to the specific needs of the exploitation field. A series of tests to prove operational capability for specific customer problems will be conducted throughout the program. The tests shall consist of image digitizing, computer manipulation, and display of various types of imagery to meet the requirements of the customer during the 12-month period. The system program packages developed or adapted during this period will be included as a part of the materials to be furnished on the program.

II. Documentation

Operator training and instruction manuals for use of the equipment and program packages will be included.